# Pattern of morbidity and mortality in Karbala hospitals during Ashura mass gathering at Karbala, Iraq, 2010

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**أنماط المراضة والوفيات في مستشفيات مدينة كربلاء أثناء الحشود في ذكرى عاشوراء، كربلاء، العراق، 2010**

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**الخلاصة:** تزداد الحشود في المناسبات الدينية في العراق، وهي حشود قد تُعرِّض إلى مخاطر على الصحة العمومية. وكان الهدف من هذه الدراسة تحديد أنماط المراضة والوفيات في المستشفيات بمدينة كربلاء، بالعراق، أثناء الحشود بمناسبة إحياء ذكرى عاشوراء في العام 2010. وأجرى الباحثون دراسة مُستَعرضة على المترددين على ثلاثة مستشفيات عامة بالمدينة. وقُسِّمَت فترة الدراسة إلى مراحل ثلاثة: ما قبل المناسبة؛ وأثناء المناسبة ذاتها؛ وما بعد المناسبة. وجُمِعت البيانات الخاصة بالمراضة والوفيات من السجلات الموجودة بالمستشفيات ومن دائرة الطب الشرعي. واتضح للباحثين أن 80٪ من الاستشارات وعددها 18 415 قد جرت في غرف الطوارئ. وكان متوسط التردد اليومي على غرفة الطوارئ أعلى أثناء المناسبة مُقارَنة بالمرحلتين الأخريين ما قبل المناسبة وبعدها، مع انخفاض متوسط الإدخال اليومي بالمستشفيات. وبعقد مُقارَنة مع المرحلة السابقة على المناسبة، لُوحِظ أثناء المناسبة ارتفاع الاضطرابات الحمَّوية بواقع سبعة أضعاف، والأمراض المزمنة والإصابات بواقع الضعفين. ولم يختلف متوسط معدل الوفاة اليومي كما لم تتفاوت أسباب الوفاة في ما بين المراحل الثلاث.

ABSTRACT Religious mass gatherings are increasingly common in Iraq and can harbour considerable public health risks. This study was aimed at determining morbidity and mortality patterns in hospitals in Karbala city, Iraq during the mass gathering for Ashura in 2010. We conducted a cross-sectional study on attendees at the 3 public hospitals in the city. The study period was divided into pre-event, event, and post-event phases. Morbidity and mortality data were obtained from hospital registry books and the coroner's office. About 80% of the 18 415 consultations were at emergency rooms. Average daily emergency room attendance was higher during the event compared with pre- and post-event phases, while average daily admissions decreased. Compared with the pre-event phase, a 7-fold increase in febrile disorders and a 2-fold increase in chronic diseases and injuries were noted during the event phase. There was no difference between the 3 phases for average daily death rate,nor for cause of death.

**Tableaux de morbidité et de mortalité dans les hôpitaux de Karbala lors du rassemblement de masse pour l'Achoura, à Karbala (Iraq), 2010**

RÉSUMÉ Les rassemblements religieux de masse sont de plus en plus courants en Iraq et peuvent engendrer des risques importants pour la santé publique. La présente étude visait à déterminer les tableaux de morbidité et de mortalité dans les hôpitaux de la ville de Karbala (Iraq) lors du rassemblement de masse pour l'Achoura en 2010. Nous avons mené une étude transversale sur la fréquentation dans trois hôpitaux publics de la ville. La période d'étude couvrait les trois phases suivantes : avant, pendant et après l'événement. Les données sur la morbidité et la mortalité ont été recueillies à partir des registres des hôpitaux et du bureau du médecin légiste. Le service des urgences a reçu près de 80 % des 18 415 consultations. La fréquentation journalière moyenne au service des urgences était plus élevée pendant l'événement qu'avant et après ce dernier, alors que le nombre moyen d'hospitalisations journalières a diminué au moment du rassemblement. On a constaté que, pendant l'événement, les accès de fièvre ont été multipliés par sept, et les maladies chroniques et traumatismes par deux, par rapport à la phase précédant le rassemblement. Il n'y avait pas de différence entre les trois phases pour ce qui concerne le taux moyen de mortalité journalière et les causes de décès.

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## Introduction

Mass gatherings are defined as pre-planned, public events held for a limited time period and attended by large number of people, typically more than 1000, although some suggest more than 25 000 [1,2]. They can be held for political, social, religious, sports, and other reasons. Comprehensive reviews of mass gathering literature have concluded that medical needs were largely determined by the event type and duration, attendance, weather, crowd mood and density, and other factors [3,4].

Mass gatherings can engender a lot of societal and governmental concerns and can result in health and socioeconomic consequences. They challenge public health vigilance and knowledge because they increase the epidemiological potential for the spread of disease to a maximum, increase the risk of injuries, and exacerbate pre-existing chronic conditions [5]. Mass gatherings add burden to the host countries and to travellers' countries of origin [6–8]. Public health systems become strained even if they are advanced and effective in preventing and controlling the endemic disease burden and even if the countries have the appropriate resources [9,10]. The mass gathering environment itself also impacts the host population by imposing added burdens on civilian infrastructures [11].

In the Middle East, the Hajj is the best known and most closely studied mass gathering. Many studies have been conducted on describing public health consequences associated with Hajj, particularly outbreaks of communicable diseases and injuries [12–14].

In Iraq, several religious mass gatherings are held throughout the year, mainly in Karbala, Najaf and Baghdad. Ashura is the third largest religious mass gathering in Karbala. It is commemorated by Shi'a Muslims as a day of mourning for the martyrdom of Husayn ibn Ali, the grandson of the Prophet Muhammad at the Battle of Karbala in 61 AH (680 CE). It is attended by millions of Muslims from within and outside Iraq [15]; all should visit the holy shrines on this day. This can result in extreme crowding, leading to increased risk of stampedes. For cultural or religious reasons, some attendees use self harm practices such as laceration of the scalp using sharp knives, etc. More importantly, owing to the high densities of people, international visibility, and symbolic means through which terrorists might amplify the effects of their action,mass gatherings are often cited as targets for terrorism [16–18]. This is particularly true for Iraq, which has experienced a number of terrorist attacks, making the prevention of such attacks the focus of the government during mass gatherings.

Religious mass gatherings follow the Islamic lunar calendar, so the date moves forward by 10–11 days every year, therefore presenting health risks associated with seasonal variation [19].

The public health impacts associated with mass gatherings are inadequately studied in Iraq. The objective of this study was to describe the pattern of morbidity and mortality in Karbala hospitals, with emphasis on emergency attendance, and type of diseases/injuries, during Ashura in 1431 Hijri (December 2010).

## Methods

A cross-sectional study was conducted in the city of Karbala (population approximately 500 000; located 100 km south-east of the capital, Baghdad) on all patients who were admitted to the hospital wards or attended the emergency room (ER) in all 3 public hospitals in Karbala (Al-Husainy General Hospital, the Obstetrical/Gynaecological Hospital and the Paediatric Hospital) during 1–26 December 2010. Morbidity data were obtained from the registry books of the hospital wards and emergency rooms (ERs) of these hospitals. Mortality data were obtained from death certificates issued by the hospitals and from the provincial coroner's office over the same period.

Data were collected on a daily basis using standardized instrument that included basic patient demographic data and provisional diagnosis or primary cause of death. The study period was divided into three phases: "pre-event" (1–14 December), "event" (15–18 December), and "post-event" (19–26 December). Although Ashura is actually a 1-day event, people usually attend 2 days earlier and stay 1 day afterwards. For planning purposes, the local government considers this as the mass gathering period to take into account the arrival and departure of attendees. We used the same period to define the "event" phase.

Because standardized case definitions or international disease classification standards are not routinely used in Iraq, we grouped provisional diagnoses into broad syndromic or body-system categories. As reliable denominator figures were not available and because the phases were of different lengths, we analysed the data through the 3 phases using average daily health-care contact rates (including hospital admissions, ER consultations, and deaths). Figures were rounded to the nearest whole number. On-way analysis of variance (*F*-test),Tukey (HSD) test and chi-squared test were used to identify significant differences in average daily figures and frequency data between the 3 phases. *Epi Info* and *SPSS* were used for data entry and analysis. $P < 0.05$ was considered statistically significant.

## Results

Data were collected on a total of 18 415 health-care contacts; Table 1 describes the basic characteristics of the study population. The majority (51%) of patients were in the 15–44 years age

group; there was an almost equal male to female ratio, and more than 97% of people seeking care at the study sites were from Karbala province. The proportion of patients in the age group < 15 years was significantly higher in the event phase (42.6%) compared to the pre- (24.2%) and post-event phases (28.9%) ($P < 0.001$).While the number of males exceeded that of females in the pre-event (52.7%), and post-event (54.4%) phases, females predominated in the event phase (55.9%)($P < 0.001$). The proportion of attendees from other provinces in Iraq constituted 2.8% in the pre-event, and 1.8% in the post-event, and only 0.4% in the event phase ($P < 0.001$).

Across the study period, about 79% of contacts were reported from ERs; about 69.2% attended Al-Husainy General Hospital, 9.6% attended the Obstetrical/Gynaecologic Hospital, and 21.2% attended the Paediatric Hospital. The average daily attendance to Al Husainy and the Gyn/Ob hospitals increased during the event compared with pre- and post event phases, but this was not statistically significant ($P \geq 0.05$)(Table 2). In the Paediatric Hospital there was an increase of more than 100% in average daily attendance during the event (257) compared with pre-event (109) ($P< 0.001$), and post-event (172) ($P = 0.019$).

The average daily ER consultation rate was significantly higher during the event phase (772) compared with the pre-event (480) and post-event (607) phases ($P < 0.001$)(Table 2). The average daily admissions to the hospital wards was lower in the event phase (127) compared with the pre-event (136) and post-event (169) phases, but the difference was not statistically significant($P = 0.907$).

According to provisional diagnosis, the average daily attendance for complications of diabetes was 3 times higher during the event phase compared with pre- and post-event phases ($P < 0.001$) (Table 3). Similarly, the average daily attendance for diagnoses of cardiovascular disease was significantly higher during the event phase than pre- ($P = 0.016$) or post-event ($P = 0.025$). Also, diagnosis of fever and febrile convulsions was 7 times greater during the event than pre-event, and 4 times greater than post-event phases ($P < 0.001$). Regarding injuries, the average daily attendance was significantly higher during the event compared to pre-event phase ($P = 0.041$). Although in general, the obstetrics/gynaecology attendance was not significantly different between the phases, average attendance for caesarean section was significantly higher during the post-event phase compared with the event ($P = 0.002$) and pre-event ($P = 0.038$) phases. "Other", which mainly included less urgent cases, were significantly higher in the post event compared to event ($P = 0.041$) phases (Table 3).

In general, in the pre-event phase, the ratio of noncommunicable diseases: communicable diseases: injuries was 2.4:3.7:1 for the ER, and 12.9:6.1:1 for hospital admissions. The corresponding ratio during the event phase was

**Table 1 Demographic characteristics of people ($n$ = 18 415) who attended 3 public hospitals before, during and after Ashura mass gathering, Karbala, 2010**

| Characteristic | Phase | | | | | | Total | | *P*-value |
|---|---|---|---|---|---|---|---|---|---|
| | Pre-event | | Event | | Post-event | | | | |
| | No. | % | No. | % | No. | % | No. | % | |
| ***Age (years)***[a] | | | | | | | | | |
| < 1 | 643 | 7.5 | 247 | 6.9 | 505 | 8.2 | 1 395 | 7.6 | |
| 1–4 | 832 | 9.7 | 663 | 18.4 | 763 | 12.4 | 2 258 | 12.3 | |
| 5–14 | 600 | 7.0 | 623 | 17.3 | 510 | 8.3 | 1 733 | 9.5 | < 0.001 |
| 15–44 | 4 687 | 54.5 | 1 476 | 41.1 | 3 188 | 51.8 | 9 351 | 51.0 | |
| 45–64 | 1 380 | 16.1 | 423 | 11.8 | 911 | 14.8 | 2 714 | 14.8 | |
| 65+ | 451 | 5.2 | 163 | 4.5 | 273 | 4.4 | 887 | 4.8 | |
| ***Sex***[b] | | | | | | | | | |
| Female | 4 061 | 47.3 | 2 009 | 55.9 | 2 820 | 45.6 | 8 890 | 48.4 | |
| Male | 4 527 | 52.7 | 1 586 | 44.1 | 3 366 | 54.4 | 9 479 | 51.6 | < 0.001 |
| ***Residence***[c] | | | | | | | | | |
| Karbala | 8 342 | 96.9 | 3 565 | 99.2 | 6 065 | 97.9 | 17 972 | 97.7 | |
| Other provinces | 241 | 2.8 | 15 | 0.4 | 112 | 1.8 | 368 | 2.0 | < 0.001 |
| Other countries | 23 | 0.3 | 15 | 0.4 | 15 | 0.2 | 53 | 0.3 | |
| Total | 8 612 | 46.8 | 3 597 | 19.5 | 6 206 | 33.7 | 18 415 | 100.0 | |

[a]*Age missing on 77 records.*
[b]*Sex missing on 46 records.*
[c]*Residence missing on 22 records.*

**Table 2 Average daily attendance of patients (*n* = 18 415) who attended 3 hospital departments, and average daily deaths according to event phase, Ashura mass gathering, Karbala, 2010**

| Variable | Daily average (no.) | | | *P*-value[a] | *P*-value[b] | | |
|---|---|---|---|---|---|---|---|
| | Pre-event | Event | Post-event | | Pre- vs event | Pre- vs post- | Event vs post- |
| ***Hospital*** | | | | | | | |
| Husainy | 447 | 564 | 541 | 0.05 | 0.118 | 0.107 | 0.923 |
| Gynaecology-Obstetrics | 59 | 79 | 63 | 0.362 | 0.329 | 0.908 | 0.556 |
| Paediatric | 109 | 257 | 172 | < 0.001 | < 0.001 | 0.017 | 0.019 |
| ***Hospital department*** | | | | | | | |
| Emergency | 480 | 772 | 607 | < 0.001 | < 0.001 | 0.025 | 0.037 |
| Admission | 136 | 127 | 169 | 0.075 | 0.907 | 0.101 | 0.148 |
| Deaths | 7.4 | 9.8 | 10.9 | 0.786 | 0.993 | 0.774 | 0.911 |
| ***Total*** | 615 | 899 | 776 | < 0.001 | 0.001 | 0.011 | 0.202 |

[a]*F-test.*
[b]*Tukey (HSD).*

1.5:2.7:1 in the ER, and 13.8:9.4:1 for hospital admissions. For the post-event phase, the ratio was 2.4:4.2:1 for the ER and 10.7:4.8:1 for hospital admissions.

Across the study period there were 230 deaths; 37 (16%) of these were reported from the provincial coroner's office, reflecting deaths occurring outside hospital. The proportion of deaths in the pre-event, event and post-event phases were: 45%, 17%, and 38%, respectively. Corresponding average daily deaths were: 7.4, 9.8, and 10.9, respectively but the differences were not statistically significant ($P > 0.05$) (Table 2).The most frequent causes of death throughout the study were cardiovascular disease (44.3%), respiratory disease (12.2%) and injuries (10.0%). Mortality analysis for cause, age, sex and residence across the 3 phases did not show any specific trends or statistical significance.

## Discussion

Although many religious mass gatherings are held in Iraq, to our knowledge this is the first study that describes public health issues related to such events in this country.

We found a reduction in hospital admissions during the period of the event. This contrasts with the findings of other studies that showed excess hospital admissions during mass gatherings in some neighbouring countries [12–14]. This is likely due to the modification of the health-care delivery system during Ashura and similar mass gatherings: hospitals postponed all services for non-emergency conditions. Although new, simpler, mobile and fixed health-care delivery outlets are located very close to the scene of the mass gathering, still they provide only the basic ambulatory services and first aid; more serious cases that required more professional intervention are still referred to the hospitals. The new outlets help absorb the health burden attributed to less-serious conditions during the mass gathering, particularly for visitors who are not familiar with how to access the hospitals. This is supported by the finding the majority of attendees to the 3 public hospitals in this study were local residents.

Despite an overall reduction in hospital admissions during the event, there was still an increase in hospital consultations for a number of key conditions. There was an increase in morbidity attributed to acute febrile conditions, likely reflecting acute infections and respiratory illnesses. This is consistent with other studies on mass gatherings that documented excess admissions for infectious diseases associated with overcrowding [20]. Similarly, our study demonstrated an increase in consultations for chronic diseases, particularly diabetes mellitus and cardiovascular diseases. The observed a 3-fold increase in attendance for complications of diabetes mellitus may be due to poor adherence to diet or medications during the event. In mass gatherings, noncommunicable diseases and injuries have caused more deaths and greater morbidity than have communicable diseases [21].

A 2-fold increase in injuries was noted; many were related to cultural habits such as intentional scalp lacerations practised by some attendees. Human stampedes are the most feared disaster during mass gatherings because they are frequent and are associated with a high fatality rate [22]. In Iraq in 2005 a stampede resulting in about 1000 deaths was triggered by the false rumour of a suicide bomber [23]. The increase in injuries recorded is consistent with previous studies conducted for other mass gatherings [24–26].

Conversely, the average daily admission for caesarean section, and other conditions (mostly non-urgent cases) greatly declined during the event, but markedly increased after the event. Although this could be due to the planned postponement of admission for less-urgent conditions to after the event, hindered access to the hospitals or poor triage of more severe conditions should

**Table 3 Average daily attendance at 3 hospitals according to provisional diagnosis and event phase, Ashura mass gathering, Karbala, 2010**

| Provisional diagnosis | Daily average (no.) | | | *P*-value[a] | *P*-value[b] | | |
|---|---|---|---|---|---|---|---|
| | Pre-event | Event | Post-event | | Pre- vs event | Pre- vs post- | Event vs post- |
| Complication of chronic disease | 78.5 | 135.0 | 78.1 | < 0.001 | < 0.001 | 0.999 | < 0.001 |
| Cardiovascular disease | 61.6 | 89.5 | 61.3 | 0.016 | 0.016 | 0.999 | 0.025 |
| Diabetes mellitus | 16.8 | 45.5 | 16.7 | < 0.001 | < 0.001 | 1.000 | < 0.001 |
| Fever/febrile convulsion | 13.0 | 92.0 | 22.4 | < 0.001 | < 0.001 | 0.105 | < 0.001 |
| Gastrointestinal tract disease | 173.0 | 199.7 | 210.4 | 0.475 | 0.785 | 0.496 | 0.967 |
| Neuropsychiatric illness | 23.0 | 41.5 | 39.4 | 0.039 | 0.123 | 0.073 | 0.974 |
| Pregnancy-related disorder | 57.5 | 68.3 | 60 | 0.719 | 0.696 | 0.968 | 0.832 |
| Caesarean section | 6.0 | 3.0 | 10.7 | 0.002 | 0.124 | 0.038 | 0.002 |
| Normal vaginal delivery | 27.0 | 34.0 | 28.7 | 0.69 | 0.939 | 0.794 | 0.705 |
| Other gynaecological/ obstetric disorders | 24.3 | 31.2 | 20.5 | 0.396 | 0.602 | 0.78 | 0.364 |
| Respiratory illness | 102.2 | 154.7 | 152.7 | 0.034 | 0.137 | 0.056 | 0.997 |
| Injury | 74.4 | 153.7 | 90.1 | 0.053 | 0.042 | 0.792 | 0.156 |
| Other (general) | 93.3 | 54.2 | 122.7 | 0.018 | 0.163 | 0.185 | 0.014 |

[a] *F-test.*
[b] *Tukey (HSD).*

be still considered as a contributing factor.

There was a slight non-significant increase in mortality in the post-event phase that could be attributed to an accumulation of excess morbidities in the event phase, particularly complications of chronic diseases, infections and injuries.

There were a number of limitations to this study. Because the temporary health outlets did not keep any health contact information, and data from other health outlets were not included, we were unable to accurately measure the overall burden during the event, especially the less-severe illnesses and injuries. There may have been some degree of misclassification of illnesses both due to the lack of the use of standardized disease classification as well as the use of provisional instead of final diagnoses.

To sum up, the mass gathering we studied was associated with an increase in ER attendance and consultations for febrile conditions, complications of chronic diseases, and injuries, besides a reduction in hospital admissions and no change in mortality. To facilitate better planning and response, we recommend implementing public health surveillance during mass gatherings which covers all the health-care delivery outlets and which is capable of identifying the burden and trend of various health disorders. Finally, it is recommended to implement use of the International Classification of Diseases 10 (ICD-10) in health facilities as this will help in better understanding the pattern and trend of morbidity and mortality and facilitate implementation and evaluation of control and preventive measures.

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